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Abstract of a Paper on the Physiological Law of Mortality, and on certain Deviations from it observed about the Commencement of Adult Life. By PROFESSOR A. BUCHANAN, M.D., University of Glasgow.

[Read before the Statistical Section of the British Association for the Advancement of Science, at Glasgow, 14th September, 1855.]

I. THE object of the first part of this memoir was to determine the normal course of mortality as affected by age alone, without reference to other circumstances.

What we name the law of mortality is not a simple law, but a compendious expression, by which we denote the operation of various laws, physiological, physical, and moral. Of these, the physiological laws are so uniform in their operation that they impress certain characteristic features upon the law of mortality, according to age, which are observed amidst all the diversities which it exhibits under varying circumstances, physical and moral.

Of the physiological laws subordinate to the general law of mortality, the principal by far is the *law of natural decay*, which regulates not the human organism alone, but every organism, animal and vegetable, fixing the limits of its period of existence. This law must not be supposed to operate only in cases of extreme old age. Every child, at birth, contains within it the elements of its own decay; so that, although placed in the most favourable external circumstances, and exempted from all noxious influences, the series of organic actions in which life consists would come spontaneously to a termination: and this takes place at all ages, as we infer from seeing health decline and a fatal disease declare itself, without the intervention of any external cause known to be hostile to human life.

The law of infantile mortality, again, depends upon causes of a different kind. The principal of these is the transition from uterine to independent life, which occasions a great change in all the actions of the bodily organs, and in the conditions and circumstances in which they are carried on; whence many infants perish in the transition, from the conditions necessary to the former mode of life being interrupted, while those necessary to the latter are not established with sufficient promptitude, or only imperfectly established. At a later period the mortality is kept up by the delicacy and vascularity of the tissues, the great excitability of the nervous system, now first exposed to irritation, the great size of the head, and the unequal development of other organs.

The mortality of early infancy is exactly similar in kind to the mortality (if that name can be applied to the destruction of embryonic life) attendant on the transition from ovarian to intra-uterine life, when a still more complete revolution takes place in all the actions of the system, and a new series of relations to the maternal organs is established.

To these physiological laws the uniformity in the course of mortality corresponding to age is to be ascribed: for whatever deviations occur in different communities from a difference in external circumstances, the general direction is the same in all, marked by a great excess of deaths, gradually decreasing, in early life; a similar excess, gradually increasing, in advanced life; and a comparatively low rate of mortality in the intermediate period.

Of the external causes which occasion the diversities in the law of mortality in different communities, there are some which may be named *conspiring causes*, as they act in conjunction with the physiological causes above mentioned, and magnify their effects; while there are others of an *interfering* kind, that disturb the physiological results. To the latter class belong those causes that operate solely, or with peculiar intensity, at certain periods of life. Thus, a war occasions devastation among the young and strong, and disturbs the normal course of mortality. Causes, again, which operate more equably at all ages are of the conspiring class; for the physiological state of the body, varying with age, assists or resists their action. Thus the extremes of temperature tell chiefly on the infirm bodies of the young and the old, while persons in the vigour of life resist their influence.

Of the law of mortality resulting from these causes, as it is observed in England, the most prominent characters may be expressed in general terms by saying, that human life is most secure at 13 years of age, and that, as it recedes from that point towards either term of existence, it becomes less secure in a ratio which is constantly increasing.

The best mode of exhibiting the law of mortality, according to age, in its details, is by means of tables or diagrams indicating the ages at which the deaths in a large community where the number of the people is known, have been observed to take place. The most useful tables of this kind, for physiological purposes, exhibit the same number of individuals entering on each year of life, and in the earlier years upon lesser periods, and determine the proportion of them which disappear by death in each year or lesser period.

The following table, computed from a table of a different form,

published in the Fifth Report of the Registrar-General (for 1843), exhibits the law of mortality which prevails in England for a sufficient number of ages to show its general course—diminishing gradually till 13 years of age, and gradually increasing after that age :—

Years.	Deaths in 100.	Years.	Deaths in 100.
1	14·631	35	1·087
2	6·169	48	1·508
3	3·300	60	2·733
6	1·428	70	5·892
8	·934	75	8·605
10	·659	80	12·487
11	·555	85	17·936
12	·519	90	25·441
13	·500	95	35·555
14	·597	100	36·000
20	·793	105	50·000
24	·871	106	100·
29	·977		

The numbers in this table denote the average mortality for a whole year; but during the greater part of life no great error arises from employing the same numbers to denote the relative rates of mortality for any lesser periods in the same year, although, strictly speaking, each number in the table belongs only to one such period, and all the rest have numbers either above or below that in the table. This difference is so great in the first years of life, that separate observations require to be made to determine the rate of mortality at different parts of them. The following table of this kind stops short where it becomes identical with the former table, from its being unnecessary to distinguish the different rates of mortality at different parts of the same year. The numbers, properly speaking, denote the deaths at each age out of 10,000 children in 3·65 days, or the hundredth part of a year :—

1st week	240·1
2nd to 4th week	80·
2nd month	35·3
4th do.	21·9
6th do.	16·2
2nd half year	12·1
3rd do.	10·7
4th do.	7·7
3rd year	3·3
6th do.	1·4

II. The second part of the memoir, to which the first was intended as an introduction, was devoted to the consideration of

certain anomalies in the course of mortality that present themselves at the commencement of adult life.

The anomalies in question were first pointed out in Mr. Finlaison's report on the mortality among the Government annuitants, published in the year 1829—a report of great interest, as exhibiting the law of mortality that prevails among “the highest and most affluent orders of society” in this country. Among them the mortality in the male sex exhibits this peculiarity:—Starting from 13 years of age, the point of greatest security in life, the mortality increases till the age of 23, after which, instead of continuing to increase, it decreases till the age of 34, and then it increases at so slow a rate that at the age of 48 it is still somewhat less than at 23. The rates of mortality at these remarkable epochs are as follows, contrasting them with the corresponding rates in the table given above:—

Age.	Rates of Mortality.	
	Annuitants.	Average.
13	·574	·500
23	1·507	·871
34	1·170	1·087
48	1·487	1·508

These results have been confirmed and generalized by M. Quetelet from the statistical returns for the kingdom of Belgium, the only difference being, that it is from 24 to 30 that the mortality is observed to diminish. Quetelet ascribes the great mortality at 23 or 24 to the violence of the passions at that age; and he holds that the same results occur among females, although obscured by the increased mortality among them at a later age, from dangers peculiar to the sex.

If these views of M. Quetelet be correct, the course of mortality just described ought not to be considered as anomalous, but, on the contrary, as the regular course of mortality, resulting from the constitution of human nature, of which the passions form an essential part. The preponderance of statistical evidence, however, is on the opposite side of the question. The strongest by far is that of the Registrar-General, as given in the table already quoted, which shows a progressively increasing mortality from 13 years upwards, both on the average and among males alone. The same progression is exhibited in Mr. Milne's table of mortality for Sweden and Finland, and in Mr. Ansell's tables of the mortality among the members of the Friendly Societies throughout England.

If, again, the course of mortality exhibited in Mr. Finlaison's tables be regarded, not as normal, but as exceptional, it is clear

that some other cause must be sought for it than one of universal operation—the influence of passions inherent in human nature. A more probable cause the author held to be one which has no existence in childhood, and scarcely in boyhood; but which comes into operation at the commencement of active or independent life, from about 14 to 25 years of age, arising somewhat earlier among the poorer classes, and later among the wealthy; and among the latter existing exclusively among males, and attaining a much more formidable height than among the poor. It is at this period that children, who had been previously provided for by their parents, are called upon to provide for themselves. They had previously been nourished like branches on the parent stem; they are now severed from that stem, and if they fail to take root or to derive nourishment from the soil in which they are placed, they speedily decay. It is exactly so with young men on first establishing themselves in the world. We then see the effects of neglected education, vicious habits, bad dispositions, and ungovernable passions, which render them unable to avail themselves of resources within their reach; but we see also, what is more to be deplored, the effects of over-population and of other political causes which tend to straiten subsistence, and thus prevent the rising generation from obtaining a footing in society. It is this struggle, or rather the anxiety, fatigues, dangers and privations, attendant upon it, that are the true causes of the increased mortality which marks the commencement of adult life. This was illustrated by the increased mortality that takes place among young medical men between 22 and 30 years of age. Now the Government annuitants were placed in early life in circumstances not dissimilar: and the effect of these circumstances in producing the irregular course of mortality among them is well seen by contrasting it with the mortality regularly increasing with years observed among the members of Friendly Societies, according to Mr. Ansell's tables; for the circumstances of the latter were less conducive to health and comfort than those of the former, with the exception of the important circumstance that the latter, as members of a Friendly Society, were not only able to maintain themselves, but to make a provision for a time of sickness, or a posthumous provision for those related to them, in the event of death.

To illustrate the course of life and rates of mortality among the lower orders of society, reference was made to Mr. Neison's *Contributions to Vital Statistics*, derived, like the work of Mr. Ansell, from the records of the Friendly Societies of England.

The conclusion was, that while there is, among those following certain employments, there is not among them generally, any such increase in the rate of mortality at the commencement of adult life as to indicate such a difficulty as that which exists higher in the social scale, of obtaining a position in society; but that, to counterbalance this, there are sudden and repeated augmentations of the rates of mortality occurring at irregular periods, and produced most probably by the pressure of numbers and the varying demands for labour, as well perhaps as by circumstances not well understood in the nature of particular employments. Thus, among agricultural labourers the mortality comes to a maximum at 23, and declines to a minimum at 30, just as among the Government annuitants. Among country workmen, not labourers, there is a maximum at 19 and a minimum at 25, and another maximum at 30 and a minimum at 32. Among miners there is a first maximum at 22 and a minimum at 29, and a second maximum at 34 and a minimum at 37. Among clerks the first maximum is at 28 and the minimum at 35; the second maximum is at 44 and the minimum at 47. Among plumbers and painters the first maximum is at 18 and the minimum at 25; the second maximum at 33 and the minimum at 38. Among bakers there are three maximums, at 18, 31, and 49, and three minimums, at 22, 38, and 54. Among the female workers the course of mortality is very anomalous, decreasing from the earliest period till 24 years of age, and then increasing till 28 and decreasing till 33.

By what means the Status of a Profession is to be Improved.

THOSE of our readers who are in the habit of consulting the pages of the daily press will scarcely have failed to observe an account of the proceedings of the Royal Institute of British Architects, at their opening meeting for this session, held a short time back. As it may, however, have escaped the observation of some, we subjoin a brief abstract of it, omitting such portions as are irrelevant to our present purpose. The meeting was presided over by Mr. Tite, M.P.; and that gentleman, after the routine business had been disposed of, proceeded—in accordance, as it appears, with the usual custom—to address the members upon the events